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ABSTRACT

The National Education Monitoring Project (NEMP) conducts annual surveys of the achievement of grade 4 and grade 8 students in the New Zealand education system. This paper compares the 1995-98 results for Maori and non-Maori students. Results in 15 curriculum areas are compared for Maori versus non-Maori students using the total sample and using a sample of Maori students who attended schools in which enrollment was 10-30 percent Maori. The restricted sample avoids the confounding influence of low socioeconomic status found in schools with high Maori enrollment. Overall, Maori students performed less well than their non-Maori counterparts in most curriculum areas, but there was considerable variation in comparative performance across the 15 curriculum areas, together with some substantial changes between grade 4 and grade 8. In addition, the results show that ethnicity and socioeconomic status are seriously confounded in the overall sample, since the relative achievement of Maori students is considerably higher in the restricted sample, with deficits in fewer curriculum areas. The patterns of achievement differences between girls and boys at both grade levels were very similar for Maori and non-Maori students. Suggested explanations for achievement differences between Maori and non-Maori students have included differences in innate abilities, preschool experiences, in-school experiences, and home and community support for learning. NEMP results provide support for all these explanations except innate abilities. (Contains 10 data tables.) (SV)

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New Zealand's National Education Monitoring Project: Maori Student Achievement, 1995-1998

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New Zealand's National Education Monitoring Project:

Maori Student Achievement, 1995-1998

Since 1995, the National Education Monitoring Project (NEMP) has been conducting annual surveys of the achievement of year 4 and year 8 students in the New Zealand education system. A light sampling approach is used, involving about three percent of the students (1440 students) at each year level. Tasks are administered using a variety of approaches, such as one-to-one interviews with a teacher (videotaped), team activities involving four students (videotaped), activities arranged in a series of stations, and "tests" undertaken in parallel by four students. Video clips are used as resources for many of the tasks, and extensive use is made of other visual or audio material, equipment, and supplies. Some tasks are presented and responded to on laptop computers. Over a four-year cycle, very broad coverage of the school curriculum is achieved, with 15 different learning areas covered during the cycle. The assessments are administered by about 100 experienced teachers, seconded from their schools

for this purpose for six weeks (which includes a week of special training). All marking is done after task administration is completed, and each year involves about 6000 hours work by senior university teacher education students and 3500 hours work by experienced teachers. Fuller details are given in Flockton & Crooks (1999).

In this paper, results for Maori students and all other students are compared. There have been many research reports and commentaries on education in New Zealand suggesting that Maori students were performing distinctly less well than their non-Maori classmates. The evidence has been drawn from national examinations in school subjects at upper secondary school level, from New Zealand's participation in international surveys conducted by the IEA, and from the norming of several standardised tests. More anecdotal evidence has also been used quite extensively.

One important limitation of the evidence to date has been that, with the exception of upper secondary school results, the assessments have been focussed almost entirely on reading, writing, mathematics and science. Furthermore, most of the assessments have relied on paper-and-pencil tests, often using multiple choice item formats. While these are entirely legitimate forms of assessment, they cover only part of the school curriculum, which in *The New Zealand Curriculum Framework* (Ministry of Education, 1993) is depicted as involving seven broad essential learning areas and eight groups of essential skills. Even in areas which have been covered, such as reading and science, the assessment information available to date has spanned only a modest proportion of the desired learning outcomes associated with the areas. With the first four-year cycle of national monitoring completed, we are now in a position to present a much more complete national picture of student performance at the middle and end of primary schooling (year 4 and year 8). This greatly enriches the information available about Maori student achievement. It must be emphasised, however, that the first cycle of assessment was conducted in English, and largely excluded Maori students learning in Maori language immersion settings. The second cycle of NEMP assessments is addressing this limitation by including assessment in Maori for immersion students at Year 8 level.

The comparative national results for Maori and non-Maori students in 15 curriculum areas are presented first, using analyses focussed both on statistically significant differences in task performance and average effect size. These have the interpretive limitation, however, that a much higher proportion of Maori than non-Maori students are in schools located in areas of relatively low socio-economic status (SES). The overall results therefore confound ethnicity and socio-economic factors to a quite substantial extent. In our 1998 sample, for example, 56 percent of Maori students were attending schools in the bottom three deciles of the socio-economic index used to classify New Zealand schools and their parent communities, while only 22 percent of non-Maori students were attending such schools. Similarly, 53 percent of Maori students were attending schools with more than 30 percent Maori enrolment, compared with 13 percent of non-Maori students attending these schools.

To reduce this confounding, further analyses used data only from students attending schools with 10 to 30 percent Maori students on their roll. This restricted sample has the same ethnic mix as the overall sample, but is more homogeneous in SES. The effect sizes derived from this sample therefore represent a fairer comparison of the achievements of Maori and non-Maori

students, since both groups of students were learning and performing under more similar school and community conditions.

The paper concludes with a discussion of possible reasons which have been suggested for the different achievement patterns of Maori and non-Maori students, and takes a first look at the extent to which these suggestions are supported by our new achievement evidence.

Method

In each of the 15 curriculum areas covered in the NEMP programme between 1995 and 1998, we identified all of the assessment tasks on which the performance of Maori and non-Maori students could be compared. These included all tasks performed by individual students (in one-to-one interviews, stations sessions or independent sessions), together with a few team tasks in which aspects performed by individual students were separately recorded.

An overall index of performance on each task was used. This varied from a sum of marks (over many sub-tasks, items, or attributes of the performances) to a single mark awarded according to specified criteria or a rating scale. This performance index is used for all analyses involving performance of demographic subgroups on that task.

The performance of Maori and non-Maori students on each task was then compared, using a t-test on the total sample of students who attempted the task at the year level. With approximately 450 students attempting each task, the t-tests were sensitive to quite small differences. To reduce the likelihood of attention being drawn to unimportant differences, the critical level for statistical significance was set at $p = .01$ (so that differences this large or larger would not be expected by chance in more than one percent of cases). The results for each curriculum area were then tabulated, indicating the percentages of tasks on which Maori students performed statistically significantly worse than non-Maori students, statistically significantly better than non-Maori students, or similarly enough that the differences were not statistically significant.

The t-test analysis data were then used to calculate effect sizes comparing the achieve-ment of Maori and non-Maori students. On each task, the mean score obtained by non-Maori students was subtracted from the mean score obtained by Maori students, and the difference was divided by the standard deviation of the scores obtained by the non-Maori students. This effect size gives a measure of the magnitude of the difference that is independent of the sample size and indicative of the strength of the difference. If the scores on the task are approximately normally distributed, effect sizes can be interpreted using percentile ranks. An effect size of 0.00 would mean that both Maori and non-Maori students had the same mean score on the task. An effect size of +.25 would mean that the average score of Maori students was approximately at the 60th percentile for non-Maori students (ie. an average Maori student scored as well as or better than about 60 percent of the non-Maori students). An effect size of -.50 would mean that the average score of Maori students was approximately at the 30th percentile for non-Maori students (ie. an average Maori student scored as well as or better than

about 30 percent of the non-Maori students).

For each curriculum area, the mean effect size across all tasks was calculated by averaging the effect sizes for all tasks. These effect sizes were then tabulated.

The effect sizes were then re-calculated for the sub-sample of students who attended schools with total enrolments of 10 to 30 percent Maori students. About 40 percent of students were in this category, with typical numbers for each task being 40 Maori students and 140 non-Maori students. The effect sizes were calculated, averaged and tabulated in the same way as for the total sample. Statistical significance results were not reported for the sub-sample because the smaller sample size automatically reduces the likelihood of statistical significance at the .01 level, and the option of selecting a different significance level was rejected as hard to determine and explain.

A final analysis used effect sizes to compare the performances of girls and boys. This was done, in each curriculum area, for the total sample and then for Maori students.

Results

The results for year 4 students are presented first, followed by the results for year 8 students. Within each set of results, the statistical significance table is presented first, followed by the effect sizes for the total sample and the comparative figures for the more homogeneous sub-sample.

Year 4 Results

The results of the statistical significance tests for the total sample of year 4 students are presented in Table 1. The first column shows the curriculum area, the second column the percentage of tasks on which Maori students performed statistically significantly lower than non-Maori students, the third column the percentage of tasks on which Maori and non-Maori performances were not statistically significantly different, and the final column the percentage of tasks on which Maori students performed statistically significantly higher than non-Maori students. Subjects are listed in order from those on which Maori students did best to those on which they did worst (relative to non-Maori students).

Table 1

Percentages of tasks showing statistically significant differences between Maori and non-Maori year 4 students in the total sample

Subject	Maori lower	No Signif. Diff.	Maori higher
Physical Education	0	81	19
Music	10	85	5
Technology	16	84	0
Speaking	25	75	0
Health	26	74	0
Art	27	73	0
Social Studies	36	64	0
Writing	46	54	0
Listening	50	50	0
Information Skills	55	45	0
Science	61	39	0
Viewing	67	33	0
Mathematics	80	20	0
Graphs/Tables/Maps	81	19	0
Reading	100	0	0

Table 1 shows that Maori students performed less well than non-Maori students on all reading tasks, and on half or more of the tasks in six other areas. However, Maori students performed better than non-Maori students on 19 percent of the physical education tasks, and fell behind non-Maori students on less than one third of the tasks in music, technology, speaking, health and art.

The results of the effect size analysis for the full year 4 sample are presented in Table 2.

The curriculum area is indicated in the first column, the average effect size across all tasks in that curriculum area in the second column, and the percentile rank of that effect size (assuming a normal distribution of task scores) in the third column.

Table 2

Mean effect sizes and percentiles (normal distribution) for the differences between Maori and non-Maori year 4 students in the total sample

Subject	Mean Effect Size	Percentile
Physical Education	+.18	57
Art	-.14	44
Social Studies	-.19	42
Health	-.20	42
Music	-.21	42
Technology	-.25	40
Listening	-.26	40
Writing	-.30	38
Speaking	-.35	36
Science	-.35	36
Viewing	-.36	36
Information Skills	-.37	36
Mathematics	-.39	35
Graphs/Tables/Maps	-.44	33
Reading	-.52	30

Average Maori performance was above the 50th percentile of non-Maori students for one subject (physical education), between the 40th and 44th percentiles for six subjects, and between the 30th and 38th percentiles for eight subjects.

The next analysis attempted to reduce the confounding of ethnicity and socio-economic factors by restricting the sample to those students attending schools with 10 to 30 percent Maori students enrolled. In all other respects, the analysis and tabulation procedures were the same as those used for Table 2. The results for the sub-sample are presented in Table 3.

Table 3

Mean effect sizes and percentiles (normal distribution) for the differences between Maori and non-Maori year 4 students attending schools with 10 to 30 percent Maori students

Subject	Mean Effect Size	Percentile
Physical Education	+.11	54
Music	-.02	49
Art	-.07	47
Speaking	-.08	47
Health	-.11	46
Listening	-.11	46
Technology	-.12	45
Social Studies	-.15	44
Science	-.17	43
Writing	-.23	41
Viewing	-.27	39
Information Skills	-.30	38
Graphs/Tables/Maps	-.30	38
Mathematics	-.32	37
Reading	-.34	37

Average Maori performance was above the 50th percentile of non-Maori students for one subject (physical education), between the 41st and 49th percentiles for nine subjects, and between the 37th and 39th percentiles for five subjects. These results represent a substantial change from those presented in Table 2. On average, the magnitudes of the effect sizes have been reduced to six-tenths of their original values, bringing the percentiles correspondingly closer to 50. Averaged across all subjects, the mean effect size was -0.165, meaning that an average Maori student was performing as well or better than 43 percent of non-Maori students.

Table 4 is the final table for year 4 students. It combines the percentile results from Tables 2 and 3, allowing the effects of reducing the confounding of ethnicity and socio-economic factors to be seen more clearly. For every subject, the percentile for the sub-sample was closer to 50 than the percentile for the whole sample. The most dramatic shift occurred for speaking, perhaps because that was the curriculum area with the fewest assessment tasks (4) included in the computations.

Table 4

Percentiles (normal distribution) for the differences between Maori and non-Maori year 4 students in the total sample and for the sub-sample of those students attending schools with 10 to 30 percent Maori students

Subject	Whole Sample	Sub-sample
Physical Education	57	54
Music	42	49
Art	44	47
Speaking	36	47
Health	42	46
Listening	40	46
Technology	40	45
Social Studies	42	44
Science	36	43
Writing	38	41
Viewing	36	39
Information Skills	36	38
Graphs/Tables/Maps	33	38
Mathematics	35	37
Reading	30	37

Year 8 Results

The results of the statistical significance tests for the total sample of year 8 students are presented in Table 5. Subjects are listed in order from those on which Maori students did best to those on which they did worst (relative to non-Maori students).

Table 5

Percentages of tasks showing statistically significant differences between Maori and non-Maori year 8 students in the total sample

Subject	Maori lower	No Signif. Diff.	Maori higher
Physical Education	5	66	29
Art	0	100	0
Music	15	85	0
Technology	25	75	0
Health	27	73	0
Listening	33	67	0
Graphs/Tables/Maps	33	67	0
Writing	39	61	0
Reading	50	50	0
Speaking	50	50	0
Viewing	57	43	0
Science	58	42	0
Information Skills	62	38	0
Social Studies	68	27	5
Mathematics	77	23	0

Table 5 shows that Maori students performed less well than non-Maori students on 50 percent or more of the tasks in seven areas. However, Table 5 also shows that Maori students performed better than non-Maori students on 29 percent of physical education tasks, that there was no difference in art, and that the differential favouring non-Maori students was less than 30 percent of tasks in music, technology, and health.

The most dramatic shifts from the year 4 results were for reading (improving from 100 percent at year 4 to 50 percent at year 8), graphs/tables/maps (improving from 81 percent at year 4 to 33 percent at year 8, and social studies (declining from 36 percent at year 4 to 68 percent at year 8).

The results of the effect size analysis for the full year 8 sample are presented in Table 6.

The curriculum area is indicated in the first column, the average effect size across all tasks in that curriculum area in the second column, and the percentile rank of that effect size (assuming a normal distribution of task scores) in the third column.

Table 6

Mean effect sizes and percentiles (normal distribution) for the differences between Maori and non-Maori year 8 students in the total sample

Subject	Mean Effect Size	Percentile
Physical Education	+.19	58
Art	-.07	47
Music	-.16	44
Health	-.18	43
Technology	-.21	42
Writing	-.25	40
Listening	-.26	40
Viewing	-.28	39
Graphs/Tables/Maps	-.29	39
Reading	-.32	37
Social Studies	-.35	36
Science	-.36	36
Speaking	-.42	34
Information Skills	-.43	33
Mathematics	-.49	31

Average Maori performance was above the 50th percentile of non-Maori students for one subject (physical education), between the 40th and 47th percentiles for six subjects, and between the 31st and 39th percentiles for eight subjects. This summary is almost identical to the corresponding summary for year 4 students.

The next analysis attempted to reduce the confounding of ethnicity and socio-economic factors by restricting the sample to those students attending schools with 10 to 30 percent Maori students on their total roll. In all other respects, the analysis and tabulation procedures were the same. The results for the sub-sample are presented in Table 7.

Table 7

Mean effect sizes and percentiles (normal distribution) for the differences between Maori and non-Maori year 8 students attending schools with 10 to 30 percent Maori students

Subject	Mean Effect Size	Percentile
Physical Education	+.27	61
Art	+.07	53
Technology	-.07	47
Music	-.08	47
Health	-.12	45
Listening	-.15	44
Writing	-.15	44
Reading	-.17	44
Social Studies	-.17	43
Information Skills	-.19	42
Viewing	-.21	42
Mathematics	-.21	42

Graphs/Tables/Maps	-.25	40
Speaking	-.28	39
Science	-.32	37

Average Maori performance was above the 50th percentile of non-Maori students for two subjects (physical education and art), between the 40st and 47th percentiles for eleven subjects, and between the 37th and 39th percentiles for two subjects. These results represent a substantial change from those presented in Table 6. On average, the magnitudes of the effect sizes have been reduced to just over six-tenths of their original values, bringing the percentiles correspondingly closer to 50. Averaged across all subjects, the mean effect size is -.135, meaning that an average Maori student was performing as well or better than 45 percent of non-Maori students.

Table 8 is the final table for year 8 students. It combines the percentile results for Tables 2 and 3, allowing the effects of reducing the confounding of ethicity and socio-economic factors to be more clearly seen. For every subject, the percentile for the sub-sample was higher than the percentile for the whole sample. The most dramatic shift occurred for mathematics, moving from the 31st to 42nd percentile.

Table 8

Percentiles (normal distribution) for the differences between Maori and non-Maori year 8 students in the total sample and for the sub-sample of those students attending schools with 10 to 30 percent Maori students

Subject	Whole Sample	Sub-sample
Physical Education	58	61
Art	47	53
Technology	42	47
Music	44	47
Health	43	45
Listening	40	44
Writing	40	44
Reading	37	44
Social Studies	36	43
Information Skills	33	42
Viewing	39	42
Mathematics	31	42
Graphs/Tables/Maps	39	40
Speaking	34	39
Science	36	37

Combined Results for Year 4 and Year 8

Table 9 summarises the results for both year 4 and year 8 students in the sub-samples from schools with 10 to 30 percent Maori students (originally presented in Table 4 and Table 8). Subjects are listed in same order as in Table 4.

Table 9

Percentiles (normal distribution) for the differences between Maori

and non-Maori year 4 and year 8 students in the sub-samples of students attending schools with 10 to 30 percent Maori students

Subject	Year 4 Percentile	Year 8 Percentile
Physical Education	54	61
Music	49	47
Art	47	53
Speaking	47	39
Health	46	45
Listening	46	44
Technology	45	47
Social Studies	44	43
Science	43	37
Writing	41	44
Viewing	39	42
Information Skills	38	42
Graphs/Tables/Maps	38	40
Mathematics	37	42
Reading	37	44

There were substantial gains (5 or more percentile points) for Maori students between year 4 and year 8 in Physical Education, Reading, Art and Mathematics. On the other hand, there were losses for Maori students of 6 percentile points in science and 8 in speaking. The median percentile at both year levels was 44, indicating a quite small average gap in performance between Maori students and other students attending schools with a 10 to 30 percent Maori roll.

The final analyses compared the performance of girls and boys. In each curriculum area, mean effect sizes for the differences in performance between boys and girls were calculated by averaging the gender effect sizes for individual tasks in that curriculum area. The same procedures were then followed for the sub-sample of all Maori students. The results of these analyses are presented in Table 10. Positive effect sizes indicate that boys scored higher than girls.

Table 10

Effect sizes for the differences between boys and girls in the total sample and in the sub-sample of all Maori students

Subject	Year 4 Whole Sample	Year 4 Maori Students	Year 8 Whole Sample	Year 8 Maori Students
Social Studies	+.13	+.16	+.13	+.09
Physical Education	+.12	+.17	+.12	-.09
Science	+.08	.00	+.15	+.01
Mathematics	+.01	+.04	-.06	-.10
Art	-.05	-.15	-.05	-.12
Technology	-.05	.00	-.06	.00
Graphs/Tables/Maps	-.07	-.17	-.04	-.05
Health	-.07	-.11	-.09	-.21
Listening	-.07	-.08	-.07	-.03
Music	-.11	-.12	-.20	-.15
Viewing	-.11	-.18	-.11	-.23
Information Skills	-.15	-.19	-.16	-.18
Speaking	-.16	-.12	-.17	-.24
Reading	-.17	-.24	-.21	-.16
Writing	-.37	-.26	-.41	-.44

Writing	-.37	-.26	-.41	-.44

There is little evidence that the performance differences between boys and girls follow a different pattern for Maori students than for the total sample. For both the total sample and for Maori students, boys performed worst relative to girls on the writing tasks. In general, boys performed best relative to girls on social studies, physical education, and science tasks, and at year 4 level in mathematics. A small exception to the latter statement was the lower physical education performance of Maori boys at year 8 level. Overall, these results suggest that literacy skills (and particularly writing) is the only area in which major concern about the relative achievement of boys and girls at primary school is clearly justified.

Discussion

Differences of achievement between Maori and non-Maori students in the New Zealand education system have been reported and discussed on many occasions. The results presented here have enriched the information available about Maori student achievement in three important ways.

First, the wide range of curriculum areas and forms of assessment within the National Education Monitoring Project has allowed the presentation of much wider-ranging data than previously available about Maori achievement in primary education. While the overall picture shows Maori students performing less well than their

non-Maori counterparts in most curriculum areas, there is considerable variation in comparative performance across the 15 curriculum areas assessed, together with some substantial changes between year 4 and year 8.

Second, this research has demontrated that comparisons of Maori and non-Maori student achievement can be misleading because the majority of Maori students attend rather different schools to the majority of non-Maori students. Ethnicity and socio-economic factors are seriously confounded in our total sample, and in most other studies of Maori student achievement. When we compare the achievement of Maori and non-Maori students on a more "level playing field"–schools with 10 to 30 percent Maori students–the relative achievement of Maori students rises considerably, with substantial deficits occurring in fewer curriculum areas.

Third, the comparisons of the achievement of boys and girls, presented in Table 10, suggest that there is little interaction between gender and ethnicity effects in the national monitoring results. The patterns for Maori children are very similar to the patterns for all children, at both year levels. This indicates that the achievement of students in a particular combination of gender and ethnicity can be predicted quite accurately by adding the separate effects of the two factors. For instance, on average boys perform worse than girls on writing tasks, and Maori children perform worse than non-Maori children. Adding these two factors together, on average Maori boys can be expected to have particularly low achievement in writing.

Numerous explanations have been suggested for the lower performance of Maori students

that has commonly been reported. Now, however, there is a need to reassess these explanations to take into account the more varied patterns of achievement reported here, and the evident confounding of socio-economic and ethnic factors in most previous research.

In the remainder of this discussion, possible explanations for the relative achievement of Maori and non-Maori students are briefly explored. Some of these explanations do not appear to fit the NEMP data at all satisfactorily, while others are more promising. The explanations have been grouped into four clusters, considering possible differences between Maori and non-Maori students in their innate abilities, learning experiences before attending primary school, in-school experiences, and home and community support for student learning in the years that the students are attending school. Many of these suggested explanations have been considered in greater depth by Chapple, Jefferies and Walker (1997), in an extended literature review which has been summarised by Else (1997).

Abilities

One hypothesis is that Maori children are born with different patterns of abilities than their non-Maori counterparts. For instance, there might be inherited differences in physique that allow Maori children to perform some physical skill tasks better than non-Maori children, or differences in intellectual or artistic abilities which lead to differences in achievement in curriculum areas such as music, art, reading and mathematics. The NEMP results provide little support for this hypothesis. At both year levels, Maori children perform a little better than other children in physical education skills, and about the same or a little worse in areas such as art music, health and technology. In other curriculum areas the results were more variable, especially within the restricted sample of schools with 10 to 30 percent Maori students. These patterns do not fit well with explanations based on ability.

Experiences Before Attending Primary School

On average, the pre-school experiences of Maori children differ substantially from those of non-Maori children. Maori children are less likely to attend formal preschool, and many of those who do so attend *Kohanga Reo*, where the focus is on the development of Maori language skills and cultural experience. These different pre-school experiences may restrict the students' opportunities to learn information and skills which are helpful in schools where English is the medium of instruction.

At home and in their community life, Maori children may also experience rather different learning opportunities to non-Maori children. On average, Maori children come from less affluent and larger families, are more likely to have just one parent at home, and have parents with lower levels of formal education. They may experience less time devoted to English literacy experiences, and particularly those relevant to the development of reading and writing skills. They may also have fewer opportunities to travel widely, or to visit museums and libraries. On the other hand, they may have more opportunity for gaining peer learning support, for learning to relate to larger social groupings, and for collaborative activities in areas such as music and sport. They may also learn to place less value on achievement in individual activities, and more on collaborative achievements. Opportunities to develop a strong sense of cultural identity will be advantageous to them in many ways, but may not be

capitalised on and further developed when they go to school.

In-school Experiences

Teacher expectancies for the Maori students within their classroom may differ from those for the non-Maori students in the classroom. These expectancies may be associated with beliefs about the abilities or attitudes of Maori students, or about environmental factors outside of the control of Maori students that affect their learning. Research elsewhere provides some evidence that teacher expectancies can affect learning significantly, but it seems unlikely that teacher expectancies are the main cause of the complex patterns of achievement reported here. Even if teacher expectancies of Maori students are causally linked to their achievement, it could be that the teacher expectancies are derived from the achievement patterns rather than the reverse. For instance, teachers may expect Maori students to perform well in physical skill tasks because they have often seen them do so. Nevertheless, teachers need to be aware of the potential influence of expectancies and work on avoiding risks for their students arising from these.

The availability or non-availability of effective models of learning behaviour can also significantly influence student attitudes and achievement. Effective models seem to students to be relevant to their situation and worthy of imitation. For instance, an admired Maori teacher who makes reading a special focus in his or her classroom may be particularly effective in promoting success in reading for Maori students. Maori teachers are in very short supply, reducing the likelihood that Maori students will find maximally effective teacher role models.

Another possibility is that teaching approaches are poorly matched with the cultural patterns and styles of learning of Maori students, and may even cause alienation if they conflict seriously with their beliefs. For instance, some cultures expect their students to learn from observation rather than verbal discourse. If the classroom provides an environment where verbal discourse is the primary mode of learning, students from these cultures will be disadvantaged.

The use of students' first language in their school learning could be expected to aid their learning, whereas instruction in a language other than their first language may cause difficulties. The proportion of Maori students whose first or strongest language is Maori but whose language of instruction is English is relatively small, but this is another factor that could contribute to performance differences between Maori and non-Maori students. The effect is likely to be greatest for those subjects which rely most heavily on formal and careful use of the English language. This description fits most areas in which Maori students performed least well compared to non-Maori.

In recent years, "opportunity to learn" has become a particular focus of research and policy scrutiny. There is every reason to expect that achievement in a domain will tend to increase as students have greater opportunity to learn the content and skills of that domain. Opportunity to learn may be constrained by such features as limited availability of high quality teaching and learning resources, frequently disrupted classroom environments, or limited time allocated to a learning area. Each of these possible factors is considered below.

About 56 percent of Maori students attend schools in the bottom three deciles of the socio-economic index used to describe New Zealand schools. This suggests that the quality and quantity of resources available to Maori students may be lower on average than those available to non-Maori students, despite targeted government funding to assist these schools. Art supplies, musical instruments, science equipment, library books, and computers may all be in short supply or poor condition. The most important resource of all may be affected negatively, too, because low decile schools often have difficulty attracting highly qualified and experienced teachers. Adults living in poorer areas may also lack the skills and opportunity to support the activities of the school, limiting the supplementary help available to the school staff which would allow them to concentrate more effectively on their main teaching tasks.

Lower decile schools may also experience a higher proportion of disrupted class time. These schools often have substantial numbers of students from unstable home backgrounds, or with clear disabilities constraining their learning, or with past educational difficulties undermining their confidence, or with poor patterns of school attendance. Such conditions can make students difficult to motivate, inconsiderate of the rest of the class, and poorly equipped to work on the same or parallel activities to other class members.

In schools where class activities are often disrupted, teachers may decide to devote greater time to activities which are more popular and less likely to be disrupted, such as physical education, art, and music. It has also been suggested that schools with a high proportion of Maori students spend more time on Maori language and cultural activities and less time on "the basics". This would reduce students' opportunities to learn the latter.

If a school's teachers are constantly changing, it is difficult to ensure an appropriate flow and coverage of learning experiences. This situation may arise more frequently in schools attended by higher proportions of Maori students, because of the socio-economic and other disadvantages often experienced by these schools.

Any or all of these factors involving opportunity to learn could contribute to the patterns observed in the NEMP results. Greater emphasis on areas such as physical education, art and music could help explain the relatively stronger performance of Maori students in these areas. The other factors mentioned could help explain both the somewhat negative trend in Maori student achievement and the more favourable picture obtained when the data was re-analysed to include only students from more similar backgrounds, attending schools with 10 to 30 percent Maori students.

In surveys of student attitudes included in the NEMP assessments, Maori students

often stand out as having more positive attitudes than non-Maori students towards learning school subjects. Certainly there is no evidence from these surveys to suggest that lower performance of Maori students follows directly from negative attitudes or poor motivation related to their schoolwork.

Home and Community Support for Learning

Many Maori students come from low-income families. In a low-income household, the resources available (such as books, computers, study area, and money) are likely to be more restricted than in a higher-income household. The environmental conditions and resources for studying and doing homework are likely to constrain the quality of study and homework. Opportunities for learning experiences related to the current areas being studied at school are also more limited. For example, if there are no books in the home, then the only reading experiences undertaken by children may be those instigated by the school, whereas children who have many books at home have greater opportunities to learn and improve their reading ability.

Students from poorer homes may also need to earn money for personal, school, or recreational expenses. Time spent in employment impacts on the time spent studying, learning through play and recreational activities, and the energy available for learning at other times of the day.

Another disadvantage of living in poor homes is the tendency for poor nutrition and overcrowding and consequently poor health. If many days of schooling are missed through ill health, or if students cannot concentrate because of hunger, it is difficult to make up for the missing or ineffective learning experiences. It may also be that in extreme cases continued poor nutrition constrains physical and intellectual develop-ment, with serious consequences for school and lifetime achievement.

Other factors which could cause a loss of continuity in learning are truancy or family mobility. Instability of school attendance can have a large impact on the continuity, flow and quality of an individual's education. If students are often changing schools because of shifts to follow parents' quests for employment, or because of a need to move to be with different caregivers, it is difficult for their education not to suffer from these relocations.

Parental education, as well as the expectations and hopes they have for themselves and their children, can have an impact on the education and expectations of the children. If parents have a low level of education, they may be unable to help their children with difficulties the children are facing with their schoolwork. Parents are often keen for their children to do better than they did at school, but may not be well equipped to support that goal.

Available adult time to interact with children and help them with their homework is often less in one parent families than in two parent families. Other factors restricting the availability of help from adults are irregular work hours (e.g. shift work), large numbers of children in the household, and extensive community commitments. All of these factors may be more common for Maori children than for other children.

Similarly, if children have many church and community group commitments, they will have less time for homework and personal activities such as reading. While family and community activities provide valuable learning opportunities, if the majority of time is spent solely in one activity, growth in other areas may suffer.

These factors are quite compatible with the data reported here. They could help account for

the reduced gap between Maori and non-Maori students when the sample was restricted to students attending schools with 10 to 30 percent Maori students enrolled. It could also be anticipated that these factors would impact more on achievement in areas such as English literacy, information skills, mathematics and science, than in areas such as physical education and art.

Conclusion

Without further research, it is impossible to reach firm conclusions about the causes of the patterns of Maori student achievement reported in this paper. Most of the possible causes suggested in the last few pages seem likely to have some relevance. Our own view is that experiences outside of the school setting deserve particular scrutiny. By the end of their eighth year of primary schooling, most children will have had about 10,000 hours inside school grounds, including about 6,500 hours in class learning programmes. In contrast, they have had about 24,000 waking hours before coming to school at age 5, and a further 30,000 waking hours outside school grounds during their primary school years. Thus their available learning time outside school totals more than five times their available learning time within school grounds, and more than eight times their available learning time in school classes. Given the differences in community and family resources and activities discussed here, substantially different patterns of student achievement for Maori and non-Maori children could well occur largely or entirely for reasons unconnected with the efforts of teachers at their schools. For instance, compared to non-Maori children, Maori children may have more opportunities in community and family life to learn sporting and other physical skills, and fewer opportunities to learn reading (in English), writing (in English), and scientific information and ideas. This hypothesis appears to fit well with the patterns of achievement observed here. We do not intend, however, to absolve the Ministry of Education and schools from all responsibility for the lower Maori achievement found in some curriculum areas, and in any case they probably need to play an important role in helping to reduce the undesirable gaps in school achievement between Maori and non-Maori. Almost certainly, that will require collaboration between Ministry officials, school staff, parents and community agencies. It will not be accomplished solely within school grounds with school staffing and resources.

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